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1 TDC MTH COM (S)

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COMMERCE

(Speciality)

(Mathematics)

(For Commerce)

Full Marks : 70

Pass Marks : 28

Time : 3 hours

*The figures in the margin indicate full marks
for the questions*

1. (a) If $a = xy^{p-1}$, $b = xy^{q-1}$, $c = xy^{r-1}$, then
show that

$$a^{q-r} \cdot b^{r-p} \cdot c^{p-q} = 1 \quad 3$$

- (b) (i) Find the value of

$$\frac{9 - 18}{17} \quad 1$$

- (ii) How many different (eight-letter)
words can be formed out of letters
of the word 'DAUGHTER' so that all
vowels occur together? 3

- (c) (i) Find the point on x -axis which is equidistant from $(3, 2)$ and $(-5, -2)$. 3
- (ii) Find the equation of a straight line which passes through the point $(-3, 7)$ and makes intercepts on the axes equal in magnitude but opposite in sign. 4

Or

- (d) (i) Solve : 3
- $$x^{2/5} - 5x^{1/5} + 6 = 0$$
- (ii) If the third, sixth and the last terms of a GP are 6, 48 and 3072 respectively, find the first term and the number of terms in the GP. 4

- (e) Find the coordinates of the point which divides the join of $(1, 8)$ and $(6, 3)$ in the ratio $2 : 3$ internally. 3
- (f) Prove that four points $(-2, 1)$, $(-1, -3)$, $(3, -2)$ and $(2, 2)$ are the vertices of a square. 4

2. (a) (i) State the conditions for existence of a limit of a function at a point. 1

(3)

(ii) If

$$f(x) = \frac{x^2 - 9}{x - 3}$$

is continuous at $x = 3$, what should be the value of $f(3)$? 1

(iii) Evaluate : 3

$$\lim_{x \rightarrow 2} \frac{x}{1 - \sqrt{1 - x}}$$

(b) Find the value of

$$\int \frac{x dx}{x^2 + 1}$$

2

(c) Differentiate w.r.t. x

$$y = 2x^{3/2} - 3 \log x + 6$$

2

(d) Find the maximum and minimum values of

$$2x^{3/2} - 3 \log x + 6$$

5

Or

(e) Write the first principle of derivatives and find the derivative of x^3 according to the first principle of derivatives. 5

(f) If $xy = ae^x + be^{-x}$, prove that

$$x \frac{d^2y}{dx^2} + 2 \frac{dy}{dx} - xy = 0 \quad 3$$

(g) Find the first-order and second-order partial derivatives of

$$z = 8x^2 + 6xy + 2y^2$$

and verify that

$$\frac{\partial^2 z}{\partial y \partial x} = \frac{\partial^2 z}{\partial x \partial y} \quad 3$$

(h) Evaluate : 3

$$\int_0^1 xe^x dx$$

3. (a) (i) Define cofactor with examples. 2

(ii) Find the value of

$$\begin{vmatrix} 2 & 3 & -1 \\ 0 & 1 & 4 \\ -2 & -3 & 1 \end{vmatrix} \quad 2$$

(iii) Show that

$$\begin{vmatrix} 1 & 1 & 1 \\ a & b & c \\ a^2 & b^2 & c^2 \end{vmatrix} = (a-b)(b-c)(c-a) \quad 4$$

(b) (i) When two matrices are said to be conformable for multiplication? 1

(ii) Find x and y if

$$\begin{bmatrix} 3 & 5 \\ 1 & y \end{bmatrix} \begin{bmatrix} 2 & -5 \\ -1 & x \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \quad 3$$

(iii) If $A = \begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix}$, prove that A^2 is a null matrix. 2

Or

(c) (i) Mention two simple properties of determinants. 2

(ii) Define singular matrix. 1

(iii) For what value of x of the matrix

$$A = \begin{bmatrix} 1 & -2 & 3 \\ 1 & 2 & 1 \\ x & 2 & -3 \end{bmatrix}$$

is singular? 3

(d) If $f(x) = x^2 - 2x - 3$, $A = \begin{bmatrix} 1 & -1 \\ -2 & 2 \end{bmatrix}$, then find $f(A)$. 4

(e) Solve by matrix method, the equations

$$x + 2y = 1$$

$$3x + y = 4$$

4

4. (a) (i) Find the value of $\log_{2\sqrt{2}} \frac{1}{8}$. 3

(ii) If $2\log a + 3\log b - 2 = 0$, then prove that $a^2b^3 = 100$. 2

(b) A sum of money invested at CI payable yearly amounts to Rs 10,816 at the end of the second year and to Rs 11,248.64 at the end of the third year. Find the rate of interest and the sum. 5

(c) Find the amount of an annuity of Rs 700 in 6 years allowing compound interest at 4%, the payment being made half yearly. 4

Or

(d) (i) Fill up the gap : 1

$$\log 5 + \log 2 = \text{---}$$

(ii) Given that $\log_b(xy^3) = m$ and $\log_b(x^3y^2) = p$, find $\log_b \sqrt{xy}$ in terms of m and p . 3

- (e) A sum of money doubles itself in 50 years at a certain rate percent of simple interest. How long will it take to double itself at the same rate of compound interest? 4
- (f) (i) Define : $1\frac{1}{2} \times 2 = 3$
(1) Annuity Due
(2) Deferred Annuity
- (ii) Find the present value of an annuity of Rs 1,000 payable for 15 years, the rate of compound interest being 5%. 3
5. (a) What is a linear programming problem? Give a general mathematical formulation for the linear programming problem. $2+3=5$
- (b) Explain the graphical method of solving a linear programming problem. 4
- (c) Solve graphically : 5
Maximise $Z = 5x_1 + 7x_2$
subject to
 $2x_1 + 3x_2 \leq 13$
 $3x_1 + 2x_2 \leq 12$
 $x_1, x_2 \geq 0$

Or

- (d) (i) Discuss briefly the application of linear programming in business and commerce. 3
- (ii) Define feasible and basic feasible solutions of a linear programming problem. $1\frac{1}{2}+1\frac{1}{2}=3$
- (e) (i) What are slack, surplus and artificial variables? 3
- (ii) Explain various steps of the simplex method involved in the computation of an optimum solution to a linear programming problem. 5

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